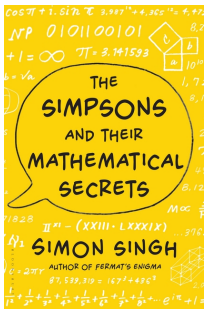
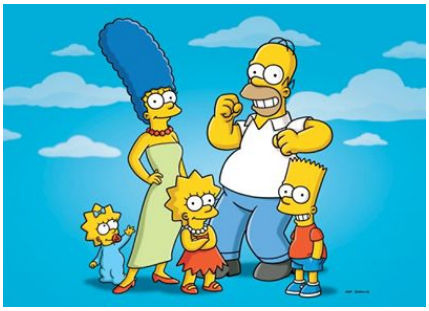
The Simpsons and Their Mathematical Secrets, 2013, Bloomsbury USA, ISBN 978-162040277-1, 26 USD (hbk), 272 pp. by *Simon Singh*.



Simon Singh

I was never a big fan of the Simpsons. I guess it will depend on when you or when your children were young whether you are a Treky, or a super fan of Monty Python, a Doctor Who addict, or a groupy of the muppets. Anyway, after reading the book by Simon Singh, I realize I may have missed something.

I knew Sing as the author of *The Code Book* (1999), a popular book about cryptography, his *Fermat's Last Theorem* (1997) and more recently *Big Bang* (2004) and *Trick or Treatment?: Alternative Medicine on Trial* (2008). At the age of 40 he has compiled a respectable CV. With a PhD in particle physics, he is science collaborator at the BBC, received an MBE and has several doctor honoris causa degrees. Enough to trigger interest if a new book comes out.



For this book, Singh analyses the mathematical puns that the authors of the Simpsons have put into several of the episodes of this sitcom. As a matter of fact, it turns out that the script writers have university degrees in mathematics and physics and are admirers of Martin Gardner's recreational mathematics. Five of the 'nerdiest writers' (as Singh calls them) are J. Stewart Burns (MS Mathematics, UC Berkeley), David S. Cohen (MS Computer Science, UC Berkeley), Al Jean (BS Mathematics, Harvard), Ken Keeler (PhD Applied Mathematics, Harvard), Jeff Westbrook (PhD Computer Science, Princeton). Singh actually met some of the writers and got some of the inside information. However, a lot of the math stuff can also be found on the web pages[1] compiled by Sarah J. Greenwald and Andrew Nestler, two enthusiastic math teachers who use these elements in their classes.

The Simpsons is a series created by Matt Groening in 1989. It started its 25th season in September 2013. It tells the human condition of a middle class family consisting of Homer and Marge and their children Bart, Lisa and Maggie. Already in the first regular show called 'Bart the Genius', we see Maggie towering alphabet blocks forming the sequence EMCSQU (obviously referring to $E = mc^2$).

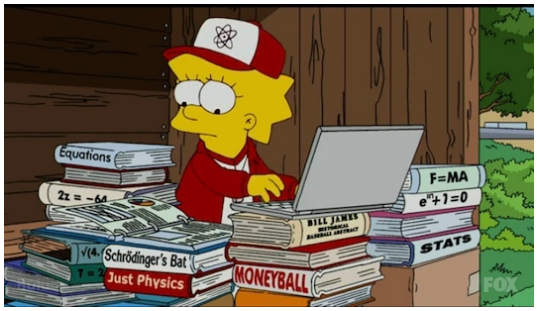
Al Jean & Matt Groening

During the first two seasons, Mike Reiss (another mathematically gifted student although he eventually chose for a major in English though) and Al Jean were the ones dropping the mathematical jokes. When they later became the executive producers, they could hire other writers with good math credentials. Often the jokes were based on English homophones, like when you read πr^2, then it sounds like 'pie are square' while a pie is round, but crackers are square.

Singh interlaces his chapters with some vignettes on mathematical humor which he organizes as a quiz. One may score a maximum of 20 points on each. One example goes as follows: Q: Why did 5 eat 6? A: Because 7 8 9, another of these word plays.

[1] `mathsci2.appstate.edu/~sjg/simpsonsmath/` and `homepage.smc.edu/nestler_andrew/SimpsonsMath.htm`

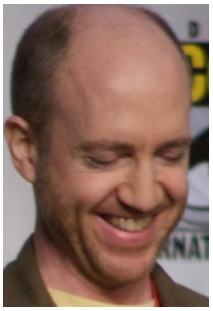
A math reference placed by David Cohen in *'Homer's last temptation'* was $3987^{12} + 4365^{12} = 4472^{12}$. This relation is obviously wrong as we all know, but if you try it out on your finite precision calculator, this is exactly what you get because of rounding errors. Homer also wrote the following formula on the blackboard $M(H^0) = \pi(\frac{1}{137})^8\sqrt{\frac{he}{G}}$. This refers to the mass of the Higgs boson particle. It results in 775 GeV, an overestimate of the 125 GeV that was measured in CERN in 2012 and for which the Nobel Prize was awarded to Higgs and Englert in 2013.



The computer scientist Westbrook of the writers team, has an Erdős-Bacon number 6. We know what an Erdős number is, and a Bacon number is similar, but refers to Kevin Bacon, an American actor, and co-authoring is replaced by co-acting. Westbrook has Erdős number 3 and Bacon number 3, giving his Edős-Bacon number 6. It somehow tells how well he is connected both in mathematics and in Hollywood circles. Westbrook has the lowest number of that sort in the Simpson team. It is difficult to do better. Dave Bayer who was consultant for and played a minor role in the film *A beautiful mind* about John Nash, so got Bacon number 2, but he also co-authored a paper with Erdős which gives him a hardly beatable Bacon-Erdős number 3. Only Bacon himself could do better if he started a mathematics career and wrote a paper with someone who has Erdős number 1, which would result in a minimal Bacon-Erdős number 2. The chances for that to happen are not so high.

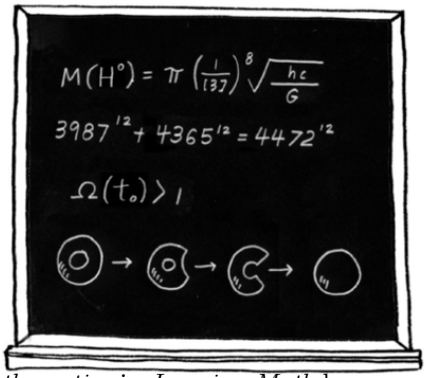

Mike Reiss


Jeff Westbrook


Ken Keeler


David S. Cohen

Lisa is particularly gifted for mathematics. In the episode *MoneyBart* her laptop rests on a book entitled *Bill James Historical Baseball Abstract*. That is an existing catalog of baseball statistics. This Bill James invented *sabermetrics*, an empirical analysis of the activity of a (baseball) player that is based upon statistics. Singh explains the technique and illustrates how Bart Simpson, by not following the rules of sabermetrics, worked out by Lisa, loses the game. In the episode *'They saved Lisa's brain'*, Stephen Hawking appears as a character. Hawking, great fan of the show especially flew over to the studio to speak a sentence via his voice synthesizer. His ideas about a doughnut shaped universe is worth another chapter where Singh is working out some topological aspects.



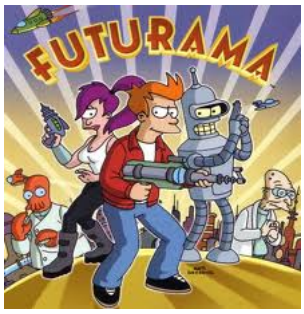
Lisa's love for mathematics is also an incentive for an episode of the Simpsons. Mathematics not being taught in the girls school, forces Lisa to dress up as a boy to attend these courses. Singh elaborates this further. It is still true that women are under represented among mathematicians, and he takes the sexist experiences of Sophie Germain as an example[2].

Of course prime numbers also play a role. At some moment, Greenwald and Nestler mentioned above visited the writers team to attend a working session. However, at the end of the day the writers realized

[2]See *Sophie's diaries* by Dora Musielak, MAA, and the chapters on *women in mathematics* in *Imagine Math* by M. Emmer, Springer (reviewed in this newsletter, issue 93, May 2013).

there was not a mathematical reference in the episode. So Westbrook smuggled in three seemingly random numbers that appeared on the Simpson's television screen. It was a multiple choice quiz where one had to guess the number of attendees of the game. The numbers are 8191, 8128, and 8208. The first turns out to be the 13th Mersenne prime $8191 = 2^{13} - 1$. The second number is the 4th perfect number (equals the sum of its divisors). The third number is a narcissistic number (it equals the sum of the powers of its digits where the power is equal to the number of its digits, i.e. $8208 = 8^4 + 2^4 + 0^4 + 8^4$).

Singh takes the opportunity at different occasions to elaborate on some of the mathematical subjects, some anecdotes, and some history. So he describes elements form game theory, the concept of infinity, sorting algorithms, $P = NP$, $e^{i\pi} = -1$, higher dimensional geometry, etc.



The book also has three chapters on *Futurama*. This is another product from Groenings brain. The idea started in 1996 and got a first broadcast in 1999. It is similar to the Simpsons, but the characters are different and it is science fiction-like so that practically every scenario is made possible. David Cohen who was a big fan of science fiction and in particular of the *Star Trek* series, was helping to shape the series. There are even more nerdy references in this series than in the Simpsons. However, they are more in the background, not standing in the way of the plot. Therefore the 'freeze-frame' technique is used to draw attention to some of them. An example: When Bender, a main character, is in a haunted castle, the digits 0101100101 are written in blood on the wall, but when he sees these in the mirror, he is terrified because 1010011010 is the binary representation of 666, the Number of the (Binary) Beast. Here is another one: $\mathrm{II}^{\mathrm{XI}} - (\mathrm{XXIII} \cdot \mathrm{LXXXIX})$. After translation from roman to arabic, it becomes $2^{11} - (28 \times 89)$ which is 1. Hence $2^{11} - 1 = 23 \times 89$ and $2^{11} - 1$ is the smallest number of the form $2^n - 1$ that is not prime. Also the number 1729 pops up several times in the series. This is special because the 1729th digit of e marks the place where all the ten digits occur consecutively: the sequence is 0719425863. You might also recognize it as the number of the taxi in which Hardy picked up Ramanujan with the famous anecdote that Hardy thought it a rather dull number whereupon Ramanujan promptly replied that it was the first number that could be written as the sum of two cubes in two different ways. Since then the number 1729 has become popular and many other funny properties were discovered: is a *harshad number* (a term coined by the Indian mathematician D.R. Kaprekar). In Futurama, a taxi cab has number 87539319 which is the smallest number that can be written in three different ways as a sum of two cubes.

Singh also elaborates on the so-called *Futurama* or *Keeler theorem*. At some point in the episode *'The Prisoner of Benda'*, a machine can switch the minds of persons, but can not do the same operation on the same persons twice. So things get mixed up and in the end seven minds were moved to bodies that were not their own. To close the episode with an happy ending, all minds should end up in their original bodies. However, a solution is not always possible, unless some extra characters are thrown in the switching process. Ken Keeler solved the problem and proved, that whatever the number or whatever the mixup, only two extra persons are needed to fix everything. Keeler never published the theorem formally, but it inspired a research paper in the *American Mathematical Monthly*.

A most entertaining book that will teach some mathematics for the lay readers and give a lot of fun for the mathematician. It makes you part of the fun that the writers obviously have in producing the shows.

Adhemar Bultheel